R16

Code No: 133BQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, April/May - 2018

SIGNALS AND STOCHASTIC PROCESS

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) What is meant by Total response? [2]
b) Define Unit step function and Signum function. [3]
c) State "time shift" property of Fourier transform. [2]
d) Define aliasing effect? How can you overcome? [3]
e) What is the time shifting property of Z transform? [2]
f) Define inverse Laplace transform. State the linearity property for Laplace transforms. [3]
g) Give an example of evolutionary random process. [2]
h) List the properties of Cross correlation function. [3]
i) Define wiener khinchine relations. [2]
j) State any two properties of cross-power density spectrum. [3]

PART-B

(50 Marks)

2. Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$. [10]

OR

3. Obtain the impulse response of an LTI system defined by dy(t)/dt + 2y(t) = x(t). Also obtain the response of this system when excited by e^{-2t} u(t). [10]

4. State and prove sampling theorem for band limited signals. [10]

OR

5.a) State and prove Differentiation and integration properties of Fourier Transform.
b) Obtain the expressions to represent trigonometric Fourier coefficients in terms of exponential Fourier coefficients. [5+5]

6. Determine the inverse Laplace of the following functions.
a) 1/s(s+1) (s+3) b) $3s^2+8s+6$ / (s+8) (s^2+6s+1). [5+5]

OR

7.a) Find the Inverse Z transform of

$$X(z)=\frac{z+2}{4z^2-2z+3}\ ;\ |z|<\sqrt{\frac{3}{4}}$$

b) Find the Z transform of x [n] = a^{n+1} u [n+1]. [5+5]

8.a) X(t) is a random process with mean =3 and Autocorrelation function $R_{xx}(\tau) = 10[\exp(-0.3|\tau|)+2]$. Find the second central Moment of the random variable Y=X(3)-X(5).

b) $X(t)=2A\cos(W_c t+2\theta)$ is a random Process, where 'θ' is a uniform random variable, over $(0,2\pi)$. Check the process for mean ergodicity. [5+5]

OR

9.a) A random process is defined as $X(t) = A\cos(\omega_0 t + \Theta)$, where Θ is a uniformly distributed random variable in the interval $(0,\pi/2)$. Check for its wide sense stationarity? A and ω_0 are constants.

b) Given the auto correlation function for a stationary ergodic process with no periodic components is $R_{XX}(\tau) = 25+4/(1+6\tau^2)$. Find mean and variance of process X(t). [5+5]

10.a) Compare and contrast Auto and cross correlations.

b) If $Y(t) = A\cos(w_0 t+\theta)+N(t)$, where 'θ' is a uniform random variable over $(-\pi,\pi)$, and N(t) is a band limited Gaussian white noise process with PSD=K/2. If 'θ' and N(t) are independent, find the PSD of Y(t). [5+5]

OR

11. Given $R_{XX}(\tau) = Ae^{-\alpha|\tau|}$ and $h(t) = e^{-\beta t}u(t)$ where $u(t) = \begin{cases} 1: & t \geq 0 \\ 0: & otherwise \end{cases}$. Find the spectral density of the output Y (t). [10]

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